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☐ 1. Document ID: US 20030020974 A1

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L1: Entry 1 of 6 File: PGPB Jan 30, 2003

PGPUB-DOCUMENT-NUMBER: 20030020974
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030020974 A1

TITLE: Image processing apparatus, image processing method and information recording medium

PUBLICATION-DATE: January 30, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Matsushima, Yuki	Kanagawa		JP	

US-CL-CURRENT: 358/521

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 2. Document ID: US 20030016956 A1

L1: Entry 2 of 6 File: PGPB Jan 23, 2003

DOCUMENT-IDENTIFIER: US 20030016956 A1
TITLE: Toner replenishment based on writer current

Summary of Invention Paragraph:
[0019] Further methods use pixel count and pixel type to manage toner replenishment. U.S. Pat. No. 5,724,627 (Okuno, et al.) uses a correction coefficient determined on the basis of the pixel frequency at each density level of a document read by image scanning, combined with tone curves and tone expression patterns (set by the emission duty ratio and emission cycle of the laser which exposes the photosensitive member) selected by an operator. The method is defined for laser printers and copiers. U.S. Pat. No. 4,847,659 (Resch) uses a toner depletion signal proportional to the number of character print signals applied to a print head, the characters preferably being pixels to be toned.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 3. Document ID: US 5724627 A

h e b b g e e e f e c ef b e

L1: Entry 3 of 6 File: USPT Mar 3, 1998

DOCUMENT-IDENTIFIER: US 5724627 A
TITLE: Image forming apparatus which calculates toner consumption in accordance with tone correction

Detailed Description Text (2):
The full color copying apparatus of the disclosed embodiment of the invention uses a correction coefficient that is determined on the basis of the pixel frequency at each density level of a document read by image scanning, as well as tone curves and tone expression patterns (set by the emission duty ratio and emission cycle of the laser which exposes the photosensitive member) selected by an operator. This correction coefficient is used to estimate the amount of toner consumed in copying a document, so as to resupply toner based on the estimated value. Thus, the amount of toner resupplied is the same as the amount of toner consumed, and toner concentration Tc (the toner weight ratio relative to the total weight of the developer) in the developer remains constant within the toner developing device. The aforesaid tone expression pattern is determined by the emission duty ratio X (%) and the emission period N (dots) of the laser which exposes the photosensitive member. The aforesaid duty ratio expresses the percentage of the laser emission period within the N-dot period. For example, when the period N=2 (dots) and the emission duty ratio is set at 80%, laser light is emitted during 80% of the laser emission period for each 2-dot pair, and laser light is not emitted during the remaining 20% of the period. In this case, toner adheres to the copy sheet as shown in FIG. 7(b). The halftone curve and tone expression pattern are discussed in detail later.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 4. Document ID: JP 2001257884 A

L1: Entry 4 of 6 File: JPAB Sep 21, 2001

DOCUMENT-IDENTIFIER: JP 2001257884 A
TITLE: MULTI-LEVEL SCREENING BASED UPON POLYNOMIAL

Abstract Text (2):
SOLUTION: One of plural tone curves is related to respective pixels of one screening matrix. The tone curves are approximated by a polynomial and polynomial coefficients (s0, s1, a, b, and c) are determined. The polynomial coefficients are stored in a look-up table. The respective pixels of an image are mapped to corresponding pixels of the screening matrix. A corresponding polynomial coefficient for approximating the corresponding tone curve is called by the pixels and used to calculate a pixel output value from a pixel input value. The polynomial is preferably a cubic polynomial and enables easy calculation by a hardware multiplier and a mathematical logic unit by using a digital signal processor.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 5. Document ID: EP 1120958 A2

L1: Entry 5 of 6 File: EPAB Aug 1, 2001

DOCUMENT-IDENTIFIER: EP 1120958 A2
TITLE: Polynomial based multi-level screening

Abstract Text (1):
CHG DATE=20010904 STATUS=O> This invention is a computer implemented method of approximating a gray scale tone with a more limited range image producer. One of a plurality of tone curves (Fig. 20) is associated with each pixel of a screening matrix. The plural tone curves are approximated by a polynomial and the polynomial coefficients (s0, s1, a, b, c) are determined. The polynomial coefficients are stored in a look-up table. Each pixel of an image is mapped to a corresponding pixel of the screening matrix. For each pixel the corresponding polynomial coefficients approximating the tone curve are recalled and used to compute a pixel output value from a pixel input value. The polynomial is preferably of the third degree polynomial and in a form easily computed using a digital signal processor with a hardware multiplier and arithmetic logic unit. Screening in this manner requires less memory storing the screening data than the prior art pure look-up table screening.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Desc	Ima

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6. Document ID: EP 1120958 A2, JP 2001257884 A

L1: Entry 6 of 6 File: DWPI Aug 1, 2001

DERWENT-ACC-NO: 2001-627552
DERWENT-WEEK: 200173

TITLE: Computer implemented gray scale tone approximation for network printer, involves recalling polynomial coefficients approximating tone curve and computing pixel output value from pixel input value of image pixel

Basic Abstract Text (1):
NOVELTY - Each pixel of an image is mapped to a corresponding pixel of screening matrix. The coefficients of polynomial that approximate the tone curve associated with screening matrix pixel that is mapped to image pixel are recalled. A pixel output value is computed from input value of image pixel and recalled polynomial coefficient.

Standard Title Terms (1):
COMPUTER IMPLEMENT GRAY SCALE TONE APPROXIMATE NETWORK PRINT RECALL POLYNOMIAL COEFFICIENT APPROXIMATE TONE CURVE COMPUTATION PIXEL OUTPUT VALUE PIXEL INPUT VALUE IMAGE PIXEL

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Desc	Ima

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Term	Documents
TONE	186987
TONES	45526
CURVE	515943
CURVES	218583

h e b b g e e e f e c ef b e

PIXEL	204213
PIXELS	150375
COEFFICIENT$3	0
COEFFICIENT	437314
COEFFICIENTA	1
COEFFICIENTAND	2
COEFFICIENTARE	1
((TONE ADJ1 CURVE) WITH PIXEL WITH COEFFICIENT$3).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	6

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Search Results - Record(s) 1 through 9 of 9 returned.

☐ 1. Document ID: US 20030043410 A1

Using default format because multiple data bases are involved.

L2: Entry 1 of 9 File: PGPB Mar 6, 2003

PGPUB-DOCUMENT-NUMBER: 20030043410
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030043410 A1

TITLE: Image processing method, image processing apparatus and storage medium

PUBLICATION-DATE: March 6, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Fukawa, Kimihiko	Ibaraki		JP	
Makino, Yoichiro	Kanagawa		JP	

US-CL-CURRENT: 358/2.1; 382/170, 382/266, 382/274

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 2. Document ID: US 20030020974 A1

L2: Entry 2 of 9 File: PGPB Jan 30, 2003

DOCUMENT-IDENTIFIER: US 20030020974 A1
TITLE: Image processing apparatus, image processing method and information recording medium

Detail Description Paragraph:
[0272] Namely, the luminance value on a relevant pixel j in the relevant image is referred to as an input luminance value Y1(j) (j=1, 2, . . . , N; N denotes the number of pixels), the output luminance value Y2(j) (=f1(Y1(j)) obtained after the tone curve transformation is performed on Y1(j) is calculated, and an exposure correction coefficient H(j) is calculated by the following formula (in a step S606). 5 H (j) = Y2 (j) / Y1 (j) = f1 (Y1 (j)) / Y1 (j) (33)

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 3. Document ID: US 20030016956 A1

L2: Entry 3 of 9 File: PGPB Jan 23, 2003

h e b b g e e e f e c ef b e

DOCUMENT-IDENTIFIER: US 20030016956 A1
TITLE: Toner replenishment based on writer current

Summary of Invention Paragraph:
[0019] Further methods use pixel count and pixel type to manage toner replenishment. U.S. Pat. No. 5,724,627 (Okuno, et al.) uses a correction coefficient determined on the basis of the pixel frequency at each density level of a document read by image scanning, combined with tone curves and tone expression patterns (set by the emission duty ratio and emission cycle of the laser which exposes the photosensitive member) selected by an operator. The method is defined for laser printers and copiers. U.S. Pat. No. 4,847,659 (Resch) uses a toner depletion signal proportional to the number of character print signals applied to a print head, the characters preferably being pixels to be toned.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 4. Document ID: US 6271940 B1

L2: Entry 4 of 9 File: USPT Aug 7, 2001

DOCUMENT-IDENTIFIER: US 6271940 B1
TITLE: Color negative scanning and transforming into colors of original scene

Detailed Description Text (6):
D.sub.R can be determined immediately by substituting H.sub.R in the latter equation, since the arbitrary constant C has a scanner-specific fixed value. The characteristic system curve makes it possible to calculate from D.sub.R the luminance L.sub.V of a point with neutral tone in the scene that would give rise to a density D.sub.R in the red channel of the scanner. For the determination of L.sub.V, the value of D.sub.R is plotted on the D.sub.R -axis. Next, the path of a straight line parallel to the L.sub.V -axis is followed towards the characteristic curve. From the point of intersection with the characteristic curve the path of a straight line parallel to the D.sub.R -axis is followed towards the L.sub.V -axis. On the point of intersection with the L.sub.V -axis, the value of log(L.sub.V) can be read. The value read is converted to L.sub.V by taking the antilogarithm. The so obtained value of L.sub.V is substituted in equation (1) and so are the values found for s and t by solving the linear system (1a, 1b). A value for the digital red colour value r is obtained, which is corresponding to the electrical red colour value r' that was initially used. If r is negative, because L.sub.V <L.sub.m, preferably a value r of r=0 is adopted. If r>r.sub.max, because L.sub.V >L.sub.M, preferably a value r of r=r.sub.max is adopted. The latter two conditions implement the digital window function. The steps for calculating r from r' are performed for each of the possible values of r'. Once a pair (r', r) has been calculated, the value calculated for r is stored on a memory location with index r' in the LUT defining T.sub.R. By using a look up table, a fast conversion of the entire red colour plane is possible, because the electrical colour value r', generated by the ADC, can be utilised as an index in the LUT defining T.sub.R and the digital colour value r will result immediately from the indexing step. The tone curve T.sub.R may be calculated in alternative ways by, e.g., determining a limited number of (r', r)-pairs and deriving the intermediate table values from the calculated pairs by means of linear interpolation or any form of approximation. If need be, the limited number of calculated pairs can be determined by taking an r-value and deriving an r'-value from it, which may be particularly useful, if an inversion of the characteristic curve causes difficulty. The transformations T.sub.G and T.sub.B may be drafted according to a similar procedure as described for T.sub.R. The transformation need not be performed digitally. It is conceivable that it is performed by means of electronic circuits on analogue electrical colour values r', g' and b', whereupon an ADC immediately provides the digital colour values r, g and b that are linearly related to L.sub.V. It is furthermore possible that gain G or reference voltage V.sub.0 can not be

set at all, or can only be set with a G and V.sub.0 equal for all colour components. That is usually the case on scanners of simple design or on scanners incorporating an ADC that transforms the analogue voltage signal to, e.g., twelve-, thirteen-, or sixteen-bit colour values r', g', b'. The linear relation as expressed in equation (2) still applies, p and q being fixed scanner parameters that, however, may be different for the three colour components. If such scanners perform any correction in the analogue circuit the relation between, e.g., r' and H.sub.R can still be determined theoretically or by measurement. Otherwise, the determination of tone curves T.sub.R, T.sub.G and T.sub.B proceeds as described above. Rather than drafting the characteristic system curve D.sub.R =f(L.sub.V) and using it for the determination of r and r', a graph may be drafted for r'=g(L.sub.V) for a fixed setting of the analogue circuit, particularly by setting fixed values for gain G and reference voltage V.sub.0. L.sub.V is then obtained directly by inverse evaluation of the function g in r', the further procedure being similar to the above description. The digital pixel values r, g, b are a faithful reproduction of the luminance of points of a neutral colour in the scene. Due to the fact that colour couplers or masking compounds may be incorporated into colour negatives, pixel values representing a coloured point in the scene can still contain substantial colour shifts. It has been found that the colour shifts for commercially available films are linear and additive in the log(L.sub.V)-space, which means that in that space there is a linear transformation, e.g. characterised by a 3.times.3 matrix with constant coefficients, that is compensating for the colour shifts. If the behaviour of the colour shifts would deviate from the illustrated linear model, the colour shifts can be characterised by a more complicated, non-linear model incorporating e.g. cross products with constant coefficients. The benefit of the linear approximation resides in the fact that determining the coefficients is simpler and that less calculating steps are required when implementing the transformation. The determination of the coefficients of the above-mentioned matrix will be explained further herein below. First, the conversion of electrical colour values r', g', b' into digital colour values r, g, g and their further transformation into colour-corrected colour values R, G, B will be described. The separate tone curves T.sub.R, T.sub.G, T.sub.B are determined in a similar way as explained above. However, rather than calculating the value of L.sub.V from log(L.sub.V) by taking the antilogarithm, it is advantageous to transform log(L.sub.V) linearly to the digital colour value, e.g. r. An optimum use of the available digital capacity, e.g. 256 values in case of an eight-bit digital colour value, can be provided by imaging log (L.sub.m) on 0 and log(L.sub.M) on 255. The equations 1, 1a and 1b remain valid, if L.sub.X is substituted by log(L.sub.X) in each equation. The advantage of this procedure consists in avoiding an adverse effect called posterisation. Posterisation, also called landscaping or false contouring, occurs when small colour shifts on the original give rise to markedly visible colour shifts in the reproduction, particularly if such effect is found in large areas of almost constant colour. This may be due to a restriction of the number of colour values, e.g. in four- or six-bit systems, or to an inexpert allocation of colour values to densities. Posterisation may also occur, if a number of colour values are no longer found in a colour plane as a result of some manipulations, and the histogram of a colour plane shows as it were gaps. Separations having colour values near such gap are often exhibiting posterisation. A manipulation that may give rise to posterisation is the transformation of an eight-bit signal to an eight-bit signal, the signals being interrelated according to a logarithmic relation. The logarithmic transformation is included in the tone curve for reducing the risk of posterisation. As stated before, tone curve T.sub.R transforms a colour value r' into a colour value r that has a linear relation to log(L.sub.V) for neutral tones in the scene. A similar statement applies to T.sub.G and T.sub.B. Next, the digital pixel values r, g, b can be transformed to colour-corrected pixel values respectively R', G' and B' in the log(L.sub.V)-space by means of the above-mentioned transformation matrix and that as follows:

Detailed Description Text (15):
If the scanning system has a restricted density range, such as the Arcus II scanner, marketed by Agfa-Gevaert N.V. which scans correctly a maximum density value of 1.9, it is not advantageous to pick the most white point from the original image to establish the parameters for this horizontal shift operation. The most white point will give the highest possible density obtainable by the specific scanner for each colour component, which can be significantly different for the different colour components. If the shift parameters would be based on the measurement of a "white point" that cannot be scanned

accurately, this would yield a bad transformation result for points having a density that is scanned accurately. Therefore, it is preferred to select a "white" point having a neutral colour, for which the densities are slightly below the maximum possible densities. This yields the required results. Once the effective characteristic curves are identified, the luminance range can be identified and all other colour processing steps as described above can be done to get a colour corrected image. If the highest density of every colour component on the negative colour image is lower than the maximum density reached by the scanner, the L.sub.M value will be determined by the point in the original image having the highest luminance. If the maximum density of the colour components cannot be scanned correctly by the scanning system, the luminances corresponding to the maximum achievable densities in each colour component will determine the L.sub.M value. The process for obtaining this L.sub.M value remains the same for both high end and low end scanners. If colour-corrected colour values are required after digitisation, it is furthermore necessary to determine the twelve coefficients of the transformation matrix described above. To that end, the following procedure is preferentially followed. As already described, an IT8.7/2 reference target is photographed under standard conditions, exposing thereby the selected type of colour negative material. After development, the negative picture is scanned entirely. The generic characteristic system curve is determined in the above-mentioned way, and from that curve the three tone curves T.sub.R, T.sub.G and T.sub.B are calculated. As more previously described, by transforming the electrical colour values r', g' and b' by means of the corresponding tone curves the digital colour values r, g and b are determined for every pixel on the picture. The colour values r, g and b are a linear function of L.sub.V for the neutral tones in the scene. On the other hand, the IT8.7/2 reference target is also measured colourimetrically. Of every reference swatch the tristimulus value in a colour space for a given type of display unit is determined and the three co-ordinates are re-scaled for optimum use of a given digital capacity, e.g. into 256 numerical values in an eight-bit system. The re-scaled tristimulus values denoted by A, B and C represent the target values for the colour-corrected values R, G and B. Consequently, the matrix transformation has to be determined in a way that the colour-corrected pixel values R, G and B are approximating the re-scaled tristimulus values A, B and C of the corresponding colour swatch as close as possible. Calculating the matrix elements M.sub.Cc and the vector elements R.sub.0, G.sub.0 and B.sub.0 is effected by solving an over-determined system of non-linear equations according to the method of least squares in the intensity domain A, B, C. The equations constituting the system are found by listing the colour swatches that are intentionally to be taken into account. This list preferably includes all reference swatches with a neutral colour. Also reference swatches in the scene having a cyan, yellow and magenta colour with several colour saturation levels are preferably considered. The digital pixel values r, g and b and the re-scaled tristimulus values A, B and C of the listed colour swatches are determined. The digital colour values r, g and b are transformed into the log(L.sub.V,)-space as described above. As a result, r", g" and b" are obtained. By proceeding in the same way for the values A, B and C, A", B" and C" are obtained. For each of the colour swatches the values of r", g", b", A", B" and C" are substituted in the three equations, so that for every colour swatch three additional equations are obtained for the over-determined system. The number of colour swatches being greater than four, the number of equations obtained is exceeding the number of unknowns. The problem is solved by means of conventional approximation methods such as described in the previously quoted publication "Numerical Recipes in C". In this way, the coefficients required for the colour transformation matrix are obtained. In practice, it became apparent that these matrix coefficients are only strongly depending on the film type in which other colour masks or colour couplers have been used, but are but slightly different for negative material of distinct batches of the same film type. The coefficients of the colour transformation matrix can thus universally be applied to one particular type of negative film material combined with one particular type of scanner. For every combination of film type and scanner a new set of coefficients has to be determined, preferably according to the method described above. From the above it will be clear that it is essential to determine the following relations for every film type and for every scanner:

Detailed Description Text (18):
The digital colour values are obtained by transforming the electrical colour values of each of the colour planes by means of a single tone curve obtained from the characteristic system curve for the corresponding colour component. The characteristic

system curve is specific for a batch of negative material and is derived from the generic characteristic system curve of a reference film of the same film type by matching the densities at fog level of the reference film and of the film to be digitised. The colour-corrected pixel values are obtained by transforming the digital pixel values into the log (L.sub.V)-domain, implementing on these pixel values a colour transformation matrix with constant coefficients, and performing an exponentiation on the so obtained values. The coefficients for the colour transformation matrix have to be determined on the selected scanner for a single reference film of the same film type. Whenever another scanner system is changed-over to, the characterisation steps, i.e. determination of the generic system curves and determination of the transformation matrix, have to be performed again. Although the present invention has been described with reference to preferred embodiments, it will be clear to those skilled in the art that changes in design and details may be introduced without deviating from the intention and the scope of the invention.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

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☐ 5. Document ID: US 6160643 A

L2: Entry 5 of 9 File: USPT Dec 12, 2000

DOCUMENT-IDENTIFIER: US 6160643 A
TITLE: Color negative scanning and transforming into colors of original

Detailed Description Text (26):
It is furthermore possible that gain G or reference voltage V.sub.0 can not be set at all, or can only be set with a G and V.sub.0 equal for all colour components. That is usually the case on scanners of simple design or on scanners incorporating an ADC that transforms the analogue voltage signal to, e.g., twelve-, thirteen-, or sixteen-bit colour values r', g', b'. The linear relation as expressed in equation (2) still applies, p and q being fixed scanner parameters that, however, may be different for the three colour components. If such scanners perform any correction in the analogue circuit the relation between, e.g., r' and H.sub.R can still be determined theoretically or by measurement. Otherwise, the determination of tone curves T.sub.R, T.sub.G and T.sub.B proceeds as described above. Rather than drafting the characteristic system curve D.sub.R =f(L.sub.V) and using it for the determination of r and r', a graph may be drafted for r'=g(L.sub.V) for a fixed setting of the analogue circuit, particularly by setting fixed values for gain G and reference voltage V.sub.0. L.sub.V is then obtained directly by inverse evaluation of the function g in r', the further procedure being similar to the above description. The digital pixel values r, g, b are a faithful reproduction of the luminance of points of a neutral colour in the scene. Due to the fact that colour couplers or masking compounds may be incorporated into colour negatives, pixel values representing a coloured point in the scene can still contain substantial colour shifts. It has been found that the colour shifts for commercially available films are linear and additive in the log(L.sub.V)-space, which means that in that space there is a linear transformation, e.g. characterised by a 3.times.3 matrix with constant coefficients, that is compensating for the colour shifts. If the behaviour of the colour shifts would deviate from the illustrated linear model, the colour shifts can be characterised by a more complicated, non-linear model incorporating e.g. cross products with constant coefficients. The benefit of the linear approximation resides in the fact that determining the coefficients is simpler and that less calculating steps are required when implementing the transformation.

Detailed Description Text (27):
The determination of the coefficients of the above-mentioned matrix will be explained further herein below. First, the conversion of electrical colour values r', g', b' into digital colour values r, g, b and their further transformation into colour-corrected colour values R, G, B will be described. The separate tone curves T.sub.R, T.sub.G,

T.sub.B are determined in a similar way as explained above. However, rather than calculating the value of L.sub.V from log(L.sub.V) by taking the antilogarithm, it is advantageous to transform log(L.sub.V) linearly to the digital colour value, e.g. r. An optimum use of the available digital capacity, e.g. 256 values in case of an eight-bit digital colour value, can be provided by imaging log(L.sub.m) on 0 and log(L.sub.M) on 255. The equations 1, 1a and 1b remain valid, if L.sub.x is substituted by log(L.sub.x) in each equation. The advantage of this procedure consists in avoiding an adverse effect called posterisation. Posterisation, also called landscaping or false contouring, occurs when small colour shifts on the original give rise to markedly visible colour shifts in the reproduction, particularly if such effect is found in large areas of almost constant colour. This may be due to a restriction of the number of colour values, e.g. in four- or six-bit systems, or to an inexpert allocation of colour values to densities. Posterisation may also occur, if a number of colour values are no longer found in a colour plane as a result of some manipulations, and the histogram of a colour plane shows as it were gaps. Separations having colour values near such gap are often exhibiting posterisation. A manipulation that may give rise to posterisation is the transformation of an eight-bit signal to an eight-bit signal, the signals being interrelated according to a logarithmic relation. The logarithmic transformation is included in the tone curve for reducing the risk of posterisation. As stated before, tone curve T.sub.R transforms a colour value r' into a colour value r that has a linear relation to log(L.sub.V) for neutral tones in the scene. A similar statement applies to T.sub.G and T.sub.B. Next, the digital pixel values r, g, b can be transformed to colour-corrected pixel values respectively R', G' and B' in the log(L.sub.V)-space by means of the above-mentioned transformation matrix and that as follows:

Detailed Description Text (52):
If colour-corrected colour values are required after digitisation, it is furthermore necessary to determine the twelve coefficients of the transformation matrix described above. To that end, the following procedure is preferentially followed. As already described, an IT8.7/2 reference target is photographed under standard conditions, exposing thereby the selected type of colour negative material. After development, the negative picture is scanned entirely. The generic characteristic system curve is determined in the above-mentioned way, and from that curve the three tone curves T.sub.R, T.sub.G and T.sub.B are calculated. As more previously described, by transforming the electrical colour values r', g' and b' by means of the corresponding tone curves the digital colour values r, g and b are determined for every pixel on the picture. The colour values r, g and b are a linear function of L.sub.V for the neutral tones in the scene.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 6. Document ID: US 5724627 A

L2: Entry 6 of 9 File: USPT Mar 3, 1998

DOCUMENT-IDENTIFIER: US 5724627 A
TITLE: Image forming apparatus which calculates toner consumption in accordance with tone correction

Detailed Description Text (2):
The full color copying apparatus of the disclosed embodiment of the invention uses a correction coefficient that is determined on the basis of the pixel frequency at each density level of a document read by image scanning, as well as tone curves and tone expression patterns (set by the emission duty ratio and emission cycle of the laser which exposes the photosensitive member) selected by an operator. This correction coefficient is used to estimate the amount of toner consumed in copying a document, so as to resupply toner based on the estimated value. Thus, the amount of toner resupplied is the same as the amount of toner consumed, and toner concentration Tc (the toner weight ratio relative

to the total weight of the developer) in the developer remains constant within the toner developing device. The aforesaid tone expression pattern is determined by the emission duty ratio X (%) and the emission period N (dots) of the laser which exposes the photosensitive member. The aforesaid duty ratio expresses the percentage of the laser emission period within the N-dot period. For example, when the period N=2 (dots) and the emission duty ratio is set at 80%, laser light is emitted during 80% of the laser emission period for each 2-dot pair, and laser light is not emitted during the remaining 20% of the period. In this case, toner adheres to the copy sheet as shown in FIG. 7(b). The halftone curve and tone expression pattern are discussed in detail later.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 7. Document ID: JP 2001257884 A

L2: Entry 7 of 9 File: JPAB Sep 21, 2001

DOCUMENT-IDENTIFIER: JP 2001257884 A
TITLE: MULTI-LEVEL SCREENING BASED UPON POLYNOMIAL

Abstract Text (2):
SOLUTION: One of plural tone curves is related to respective pixels of one screening matrix. The tone curves are approximated by a polynomial and polynomial coefficients (s0, s1, a, b, and c) are determined. The polynomial coefficients are stored in a look-up table. The respective pixels of an image are mapped to corresponding pixels of the screening matrix. A corresponding polynomial coefficient for approximating the corresponding tone curve is called by the pixels and used to calculate a pixel output value from a pixel input value. The polynomial is preferably a cubic polynomial and enables easy calculation by a hardware multiplier and a mathematical logic unit by using a digital signal processor.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 8. Document ID: EP 1120958 A2

L2: Entry 8 of 9 File: EPAB Aug 1, 2001

DOCUMENT-IDENTIFIER: EP 1120958 A2
TITLE: Polynomial based multi-level screening

Abstract Text (1):
CHG DATE=20010904 STATUS=O> This invention is a computer implemented method of approximating a gray scale tone with a more limited range image producer. One of a plurality of tone curves (Fig. 20) is associated with each pixel of a screening matrix. The plural tone curves are approximated by a polynomial and the polynomial coefficients (s0, s1, a, b, c) are determined. The polynomial coefficients are stored in a look-up table. Each pixel of an image is mapped to a corresponding pixel of the screening matrix. For each pixel the corresponding polynomial coefficients approximating the tone curve are recalled and used to compute a pixel output value from a pixel input value. The polynomial is preferably of the third degree polynomial and in a form easily computed using a digital signal processor with a hardware multiplier and arithmetic logic unit. Screening in this manner requires less memory storing the screening data than the prior

art pure look-up table screening.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 9. Document ID: EP 1120958 A2, JP 2001257884 A

L2: Entry 9 of 9 File: DWPI Aug 1, 2001

DERWENT-ACC-NO: 2001-627552
DERWENT-WEEK: 200173

TITLE: Computer implemented gray scale tone approximation for network printer, involves recalling polynomial coefficients approximating tone curve and computing pixel output value from pixel input value of image pixel

Basic Abstract Text (1):
NOVELTY - Each pixel of an image is mapped to a corresponding pixel of screening matrix. The coefficients of polynomial that approximate the tone curve associated with screening matrix pixel that is mapped to image pixel are recalled. A pixel output value is computed from input value of image pixel and recalled polynomial coefficient.

Basic Abstract Text (2):
DETAILED DESCRIPTION - The tone curves are associated with each pixel of screening matrix. The polynomial coefficient of the curve approximating each of multiple tone curves, are generated. The polynomial coefficients approximating each of the tone curves is stored in a look-up table. An INDEPENDENT CLAIM is also included for printer.

Standard Title Terms (1):
COMPUTER IMPLEMENT GRAY SCALE TONE APPROXIMATE NETWORK PRINT RECALL POLYNOMIAL COEFFICIENT APPROXIMATE TONE CURVE COMPUTATION PIXEL OUTPUT VALUE PIXEL INPUT VALUE IMAGE PIXEL

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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Term	Documents
TONE	186987
TONES	45526
CURVE	515943
CURVES	218583
PIXEL	204213
PIXELS	150375
COEFFICIENT$3	0
COEFFICIENT	437314
COEFFICIENTA	1
COEFFICIENTAND	2

COEFFICIENTARE	1
((TONE ADJ1 CURVE) SAME PIXEL SAME COEFFICIENT$3).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	9

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